Key Embedded HDF Metadata Attributes

The following is a brief description of a subset of key metadata attributes that are embedded in the HDF header in both ASTER Level-1A and Level-1B data sets.

SCENE FOUR CORNERS

(Under ProductMetadata.0/SceneInformation): Provides coordinate information on the four corners of an ASTER scene. These include the upper-left, upper-right, lower-left, and lower-right coordinate values for latitude and longitude in floating point decimal degrees.

SCENE CENTER

(Under ProductMetadata.0/SceneInformation): This pair of geodetic latitude and longitude coordinates denote the center of the reference band (VNIR Band-2 (for VNIR, SWIR and TIR), or SWIR Band-6 (for SWIR and TIR only), or TIR Band-11 (for TIR only)) in floating point decimal degrees.

FLYING DIRECTION

(Under ProductMetadata.0/SceneInformation): This specifies the satellite flight direction at the time of observation. An AS denotes ascending direction for daytime scenes while DE denotes descending direction for nighttime scenes. Alternatively, positive solar elevation angles indicate daytime scenes while negative solar elevation angles indicate nighttime scenes. Note: This information along with geographic location and acquisition time are used to calculate a Day-Night flag (not available in the Level-1 HDF metadata) attribute for all the higher-level products, except the ASTER DEM product (located in both the HDF and ECS metadata files). That attribute also includes a third option called Both for scenes falling in the day-night and night-day cusps.

SOLAR DIRECTION

(Under ProductMetadata.0/SceneInformation): This attribute defines the sun direction as seen from the scene center, and includes two values. The first value is the **SOLAR AZIMUTH** angle in degrees (values can range between 0 and 360) measured eastward from North. The second value is the **SOLARELEVATION** angle in degrees (values can range between <= -90 to <= 90).

POINTING ANGLES

(Under ProductMetadata.0/PointingAngles): This provides the pointing angle values for each of the three sensors (VNIR, SWIR, and TIR) in floating point decimal degrees. They range from +/- 24 telescope rotation for VNIR to +/- 8.55 pointing mirror rotation and scan mirror rotation for SWIR and VNIR sensors respectively.

MAP ORIENTATION ANGLE

(Under ProductMetadata.0/SceneInformation): This denotes the angle of rotation between the path-oriented image and the transformed map-projected coordinates. Ranging from -180 to +180, it provides the amount by which the ASTER Level-1B image is rotated from True North.

RADIOMETRIC DATABASE VERSION

(Under ProductMetadata.0/GainInformation): This provides the version number of the radiometric correction coefficients that were used to generate the Radiometric Correction Tables.

GEOMETRIC DATABASE VERSION

(Under ProductMetadata.0/GainInformation): This provides the version number of the geometric correction coefficients that were used to generate the Geometric Correction Tables.

ACQUISITION DATE AND TIME

(Under CoreMetadata.0/SingleDateTime): Calendar Date (YYYYMMDD) provides the acquisition date while TimeOfDay (HHMMSSSSSSZ) provides the acquisition time in Coordinated Universal Time (UTC).

PRODUCTION DATE AND TIME

(Under CoreMetadata.0/ProductionDateTime): This provides the production date (YYYYMMDD) and time (HHMMSSSSS local time) of the ASTER scene.

Attributes Not Supported in the HDF Metadata:

Consult diagram on solar and satellite orbital geometry components.

SOLAR ZENITH ANGLE:

Solar zenith angle is the complementary angle to the solar elevation angle. In other words, it equals 90 degrees minus the solar elevation angle.

SATELLITE ZENITH ANGLE:

The satellite zenith angle is the complementary angle to the satellite elevation angle. In other words, it equals 90 degrees minus the satellite elevation angle.

SATELLITE AZIMUTH AND ELEVATION ANGLES:

The satellite azimuth and elevation angles are not provided in the HDF metadata. They can be calculated using the satellite position, and line-of-sight vector information that are provided in the parameter tables in the HDF metadata. The following link provides a list of all the orbital geometry parameter tables, their dimensions and other details: ASTER Level-1A Orbital Geometry Parameters.

The ASTER Level-1B data set contains radiometrically calibrated DNs (in units of watts per meter2 per steradian per micrometer) quantized as 8-bit unsigned integers for the VNIR and SWIR bands, and 16-bit unsigned integers for the TIR bands. Notwithstanding the fact that the long name of an ASTER Level-1B is defined Registered Radiance at the Sensor they still are only scaled or calibrated radiances. These scaled DNs are converted to at-sensor radiance using the Unit Conversion Coefficients (UCC) in the following manner:

Radiance = (DN value - 1) * Unit Conversion Coefficient (1)

This is a standard method to integerize the radiance values with a backfill of zero values. UCC values are provided for each channel in the embedded HDF metadata under the UNITCONVERSIONCOEFFICIENT Group, INCL Object of the Product Metadata for each sensor.

The UCCs provide the inclination or slope values in units of watts/meter2/steradian/micrometer per DN. The following table provides the UCC information. They are also published in the ASTER User Handbook (pp 25 to 26).

ASTER Unit Conversion Coefficients (watts/meter2/steradian/micrometer)/DN

Band No.	High Gain	Normal Gain	Low Gain-1	Low Gain-2
VNIR 1	0.676	1.688	2.25	N/A
VNIR 2	0.708	1.415	1.89	N/A
VNIR 3N	0.423	0.862	1.15	N/A
VNIR 3B	0.423	0.862	1.15	N/A
SWIR 4	0.1087	0.2174	0.290	0.290
SWIR 5	0.0348	0.0696	0.0925	0.409
SWIR 6	0.0313	0.0625	0.0830	0.390
SWIR 7	0.0299	0.0597	0.0795	0.332
SWIR 8	0.0209	0.0417	0.0556	0.245
SWIR 9	0.0159	0.0318	0.0424	0.265
TIR 10	N/A	6.882 x 10-3	N/A	N/A
TIR 11	N/A	6.882 x 10-3	N/A	N/A
TIR 12	N/A	6.882 x 10-3	N/A	N/A
TIR 13	N/A	6.882 x 10-3	N/A	N/A
TIR 14	N/A	6.882 x 10-3	N/A	N/A

The ASTER Level-1 processing at GDS, Japan keeps the minimum and maximum radiance of the Level-1B data set constant over time. This explains why the inclination (slope) and offset scaling factors also have remained practically constant over time.